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Digital Transformation in Accounting Education: Institutıonal Correlates of Curriculum Integration Across Turkish Universities

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Abstract

This study examines institutional correlates of digital transformation integration in undergraduate accounting programs across 19 Turkish universities listed in the QS World University Rankings 2024. Using secondary data from course syllabi, Bologna learning outcomes, and institutional reports, each university was evaluated on a standardized Digital Integration Score (DIS) covering four dimensions: AI and data analytics integration, ERP/RPA content, digital competency depth in Bologna outcomes, and digital infrastructure. The coding framework was calibrated against IFAC International Education Standards (IES 2 and IES 4) and demonstrated strong inter-rater reliability (mean Cohen's κ = 0.81). The composite DIS ranged from 3 to 12 (mean = 7.00, SD = 3.13). AACSB-accredited institutions averaged 10.17 on the DIS compared to 5.54 for non-accredited institutions (Δ = 4.63, Cohen's d = 2.03). Foundation universities averaged 11.50 versus 5.80 for state universities (Δ = 5.70, d = 2.74). Ordinary least squares regression results indicate that AACSB accreditation ($\beta = 3.19$, $p < 0.05$) and QS rank ($\beta = 1.83$, $p < 0.01$) are the strongest positive correlates of DIS in the full model ($R^2 = 0.876$, adj. $R^2 = 0.829$); university age and internationalization were not significant. ERP/RPA integration (mean D2 = 1.37) and digital infrastructure (mean D4 = 1.84) were the weakest dimensions, with the largest accreditation-associated gap observed in D4 (d = 1.94). Findings suggest that accreditation mechanisms and institutional resource capacity shape digital curriculum transformation in ways that national regulatory frameworks alone—such as the centralized YÖK programme approval system—cannot substitute. The study contributes a replicable curriculum-mapping instrument with implications for accreditation policy, curriculum governance, and digital competency development in emerging higher education systems.

Keywords: AACSB Accreditation, Artificial Intelligence, Bologna Learning Outcomes, Curriculum Analysis, Digital Accounting Education, Emerging Economies.

Introduction

Artificial intelligence (AI), big data, and robotic process automation (RPA) are reshaping business processes and transforming the competency profiles required of accounting graduates. It has been projected that approximately 30% of accounting occupations face automation risk within the next decade, yet graduates' demonstrated digital competencies consistently fall short of employer expectations (1, 2). The IFAC International Education Standards (IES 2 and IES 4) identify digital literacy and AI awareness as mandatory learning outcomes, and the AACSB 2020 BSBA standards make technology integration a binding condition of accreditation (3, 4). The extent to which these standards are reflected in actual curriculum content varies considerably, particularly in emerging economies where resource constraints, accreditation coverage, and regulatory centralisation interact in complex ways. Understanding which institutional characteristics are associated with digital curriculum integration has direct relevance for accreditation policy, curriculum governance, and resource allocation strategies. Türkiye offers a well-suited context for this inquiry. Its higher education system encompasses more than 200 institutions, all operating under the centralised framework of the Council of Higher Education (YÖK), which issues binding curriculum requirements and programme approval conditions that constrain the curricular autonomy of state universities. A state university wishing to introduce a mandatory data analytics course must do so within credit limits set by YÖK; any structural reorganisation requires institutional approval. Foundation universities, by contrast, operate under a distinct legal status

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granting greater programmatic autonomy—a structural difference expected to be associated with higher levels of digital curriculum integration.

The purpose of this study is to measure the digital transformation capacity across leading Turkish institutions and to identify the institutional factors associated with variation in that capacity.

Four research questions guide the study: (RQ1) To what extent is digital transformation integration distributed across Turkish QS-ranked universities? (RQ2) Which institutional characteristics are significantly associated with digital integration scores? (RQ3) How large are the differences betweenAACSB-accredited and non-accredited institutions? (RQ4) Which curriculum dimension exhibits the greatest gap relative to international standards?

Three original contributions are made. First, this is the first empirical test of accreditation as a correlate of digital curriculum integration in the Turkish context. Second, a standardised, multi-dimensional scoring instrument (DIS) with documented inter-rater reliability is introduced. Third, a data error in a prior conference version regarding METU's accreditation status is explicitly corrected against the AACSB official database. It should be acknowledged that restricting the sample to QS-ranked institutions introduces an elite institutional bias; findings describe the leading tier of Turkish higher education and may not generalise to the broader population of over 200 universities.

Literature Review

The theoretical framing draws on neo-institutional theory and the diffusion of innovations framework. Neo-institutional theory holds that organisations operating within shared regulatory environments tend to converge on similar structures through coercive, mimetic, and normative isomorphic pressures (5). Accreditation bodies such as AACSB function as normative isomorphic mechanisms, creating binding curricular expectations that oblige member institutions to align with internationally recognised digital competency standards. Rogers' diffusion model adds a complementary layer: adoption of new educational practices depends on relative advantage, compatibility, and the resources available for implementation (6). Foundation universities—with greater financial autonomy and direct industry links—are structurally better placed to absorb the costs of digital curriculum transformation.

It has been argued that AI would automate rule-based accounting tasks while increasing demand for higher-order analytical competencies (7), and that digital technologies are reshaping the epistemological foundations of accounting practice (8). A framework for applying robotic process automation in auditing was proposed (9), while accountability mechanisms embedded in accreditation processes have been linked to faster institutional responsiveness to digital transformation (10). Despite widespread ERP adoption in enterprises, ERP coverage in curricula has consistently lagged; this gap was documented (11), and ERP-proficient accountants are increasingly expected to function as business process analysts (12). Frameworks for integrating big data and information systems competencies across core accounting courses have been proposed to close the graduate skills gap (13). It was found that graduates trained solely in manual processes struggle with automated workflows as RPA adoption grows (14). Accreditation inertia has been identified as a barrier to analytics integration in non-accredited programmes (15), and the proliferation of big data is fundamentally altering financial reporting and auditing evidence (16). It has been argued that curricula must adapt accordingly (17). Accounting education has been shown to lag behind professional digital transformation in comparable national contexts (18). The distinction between formal curriculum documents and enacted curriculum—and the resource investment required to bridge this gap—is well established in the higher education literature (19). More recently, the proliferation of generative AI tools has introduced further complexity; large language models are beginning to reshape both accounting practice and pedagogical approaches, and future extensions of the DIS framework should consider incorporating generative AI literacy as a distinct curriculum dimension.

Methodology

Sample

The sample comprises all 19 universities listed in the QS World University Rankings 2024 for Türkiye that offer undergraduate accounting or business administration programs. The QS ranking criterion was adopted for three reasons: it provides a well-established, publicly verifiable measure of institutional visibility; it enables a degree of cross-institutional comparability based on shared documentation standards; and QS-ranked institutions are most likely to maintain accessible Bologna information systems and publicly available syllabi, which are essential for the secondary data collection approach used here. This criterion necessarily restricts the sample to the internationally visible tier of Turkish higher education and may introduce an elite institutional bias; findings should therefore be interpreted as describing curriculum integration capacity among the most internationally prominent Turkish universities rather than the sector as a whole. Table 1 includes the GPS coordinates (latitude, longitude) of each institution alongside institutional characteristics.

The sampling framework excluded Gazi University because its Faculty of Economics and Administrative Sciences was transferred to Ankara Hacı Bayram Veli University under Law No. 7141 in 2018, rendering its curriculum non-comparable within the current QS-ranked cohort. Where a sampled university offered a standalone under-graduate accounting degree, that programme served as the primary unit of analysis. Where accounting was embedded within a broader business administration (BA) programme, the coding protocol identified and scored only those courses and Bologna learning outcomes with direct relevance to accounting-specific digital competencies; generic business technology courses without clear accounting application were excluded unless they appeared on the mandatory course list of the accounting track. This decision rule was applied consistently across all 19 institutions. Two universities in the sample—Istanbul Technical University and Yıldız Technical University—offer digital accounting content principally through their management programs; for these institutions, scores reflect the accounting-adjacent digital curriculum available to students in the relevant Faculty of Management programs rather than a standalone accounting degree.

Data Collection

Secondary data were systematically compiled using the most recently available institutional records and academic frameworks, covering the formal curricula active during the 2024–2025 academic cycle from four source types:

(a) official course catalogues and syllabi;
(b) publicly accessible European Credit Transfer and Accumulation System (ECTS)/Bologna module databases;
(c) program-level Bologna learning outcomes, content-analysed for digital competency references (20); and
(d) institutional reports and websites.

Accreditation data were cross-verified against the AACSB and European Foundation for Management Development (EFMD) official databases (3). Bologna information system links for Ankara University (mandatory course ICT102), Istanbul University (mandatory courses TUIS2055 and TUIS3056; R/Python electives), and Yıldız Technical University (digital expressions in Bologna program outcomes) were accessed directly. Hacettepe University's Bologna course-list pages required session authentication and could not be accessed; its scores are based on secondary sources including published faculty reports and accreditation documentation. This constitutes a measurement asymmetry that should be noted as a constraint: Hacettepe's dimension scores may be subject to greater measurement error than those of institutions whose Bologna systems were directly accessible. Sensitivity analyses excluding Hacettepe did not materially alter the pattern of results, but this caveat should be borne in mind when interpreting individual institution-level findings. Content analysis of course documents followed a two-stage procedure combining keyword-based screening with interpretive coding. In the first stage, course titles and descriptions were systematically searched for a pre-defined keyword list covering each dimension: for D1, keywords included 'artificial intelligence', 'machine learning', 'data analytics', 'Python', 'R', 'Tableau', 'Power BI', and 'business intelligence'; for D2, 'ERP', 'SAP', 'Oracle', 'Microsoft Dynamics', 'robotic process automation', and 'RPA'; for D3, 'digital competency', 'digital literacy', 'information technology', and 'digital transformation' in Bologna outcome statements; for D4, 'software access', 'digital lab', 'computer laboratory', and 'licensed software'. In the second stage, all flagged items underwent interpretive coding to determine whether the keyword reflected substantive, assessed content (level 2 or 3) or merely aspirational or incidental mention (level 0 or 1). Vague course descriptions were handled conservatively: if a course title indicated digital content but the description was absent or insufficiently detailed to confirm hands-on delivery, the item was coded at level 1 unless corroborated by additional source evidence such as a linked syllabus, Bologna outcome, or accreditation document. For example, a course titled 'Digital Accounting Systems' with no available syllabus was coded as level 1 rather than level 2, in the absence of content confirmation. All ambiguous cases were flagged and reviewed jointly by both coders before finalisation. It should be noted that publicly available syllabi and Bologna outcome documents may not fully capture the actual depth or quality of digital instruction delivered in the classroom. Differences between what is formally documented and what is enacted in practice are a recognised limitation of curriculum analysis based on secondary institutional data (19), and the present findings should be interpreted accordingly.

Scoring Instrument

Each university was assessed on four dimensions using a standardized 0–3 scale calibrated against IFAC IES benchmarks: D1—AI and Data Analytics Integration; D2—ERP and RPA Integration; D3—Digital Competency Depth in Bologna Outcomes; D4—Digital Infrastructure and Software Access. The full coding rubric for all four dimensions is presented in Tables A1–A4 in Appendix A after the references section. Tables A1–A4 provide level descriptors (0–3) and anchor examples for each dimension: Table A1 covers D1 (AI and Data Analytics), Table A2 covers D2 (ERP and RPA), Table A3 covers D3 (Digital Competency Depth in Bologna Outcomes), and Table A4 covers D4 (Digital Infrastructure and Software Access). Each table includes explicit coding decision principles to facilitate replication of the DIS instrument in other national higher education contexts. The selection of these four dimensions was grounded in two internationally recognised frameworks: IFAC IES 2 (initial professional development—technical competence) and IES 4 (initial professional development—professional values, ethics, and attitudes), which specify AI awareness, digital tool proficiency, and information technology literacy as required competency areas; and the AACSB 2020 BSBA technology integration standards, which mandate demonstrable digital competency outcomes as a condition of accreditation (3, 4). The four dimensions collectively operationalise these requirements at the curriculum level. It is acknowledged, however, that the DIS framework does not independently score several emerging competency areas that the literature increasingly considers important: cybersecurity and information security risk management, cloud-based accounting systems, distributed ledger and blockchain technology in financial reporting, and digital ethics. These domains were not scored as independent dimensions in the present study for two reasons. First, their contemporary coverage across the sampled Turkish QS-ranked universities remains insufficient to produce meaningful score differentiation across the sample—the majority of institutions had no discernible content in these areas, which would have resulted in near-uniform zero scores with no analytical utility. Second, IFAC IES and AACSB 2020 standards do not yet mandate these areas as independently assessable competency thresholds at the undergraduate level. Future iterations of the DIS instrument should consider incorporating these dimensions as the professional standards evolve, and replication studies are encouraged to assess whether their inclusion alters the ranking of institutions in more digitally mature systems.

Reliability and Consistency

To assess the reliability of the coding procedure, a 30% random subsample of universities (n = 6) was independently double-coded by a second researcher with expertise in higher education curriculum analysis, blind to the primary coder's scores. Agreement was assessed using Cohen's kappa (κ) for each dimension separately. The resulting κ values were: D1 = 0.83, D2 = 0.79, D3 = 0.82, D4 = 0.80, yielding a mean κ of 0.81. According to conventional benchmarks in the literature (21), values in the range 0.61–0.80 indicate substantial agreement and values above 0.80 indicate almost perfect agreement; the present results indicate strong inter-rater reliability across all dimensions. Discrepancies were resolved through discussion and consensus. Intra-coder reliability was evaluated by re-coding the same subsample four weeks after initial coding; the mean κ across dimensions was 0.86, confirming temporal stability.

Regression Models

To identify institutional correlates of digital integration, four stepwise OLS regression models were estimated with DIS as the dependent variable. Independent variables included: AACSB accreditation (binary; 1 = accredited, 0 = non-accredited); foundation university status (binary); QS rank (standardized; higher value = better rank); internationalization index (standardized composite of foreign student percentage and number of Erasmus agreements, YÖK 2022–23); and university age (per decade). Variance inflation factors (VIF) confirmed the absence of problematic multicollinearity across all models (all VIF <3.2). Regression diagnostics were conducted to assess model adequacy. Residual normality was evaluated using the Shapiro-Wilk test; results were consistent with normality in all models ($p > 0.10$). Heteroscedasticity was assessed using the Breusch-Pagan test; no significant heteroscedasticity was detected (all $p > 0.05$). Leverage statistics and Cook's distance were computed to identify influential observations; no single observation exceeded the conventional Cook's distance threshold of $4/(n-k-1)$, indicating the absence of unduly influential cases. The stepwise model sequence serves an exploratory purpose; given the small sample size (N = 19) relative to the number of predictors in Model 4, the risk of overfitting is non-trivial and the adjusted R^2 values should be interpreted with caution. Results are presented as descriptive associations and are not intended to support predictive generalisation beyond the sampled population. Given the cross-sectional and observational nature of the data, regression coefficients are interpreted as associations rather than causal effects. Stata 17 was used for all analyses. It should be noted that all four foundation universities in the sample hold AACSB accreditation, resulting in near-complete overlap between these two binary predictors ($\varphi = 0.89$). Coefficient estimates for each variable therefore partly reflect the shared variance of the other, and the individual effects of accreditation and foundation status cannot be cleanly separated within this sample.

Results

Sample Characteristics and Descriptive Statistics

Table 1 presents all 19 sampled universities alongside their QS rank, GPS coordinates, institutional type, AACSB accreditation status, and individual dimension scores (D1–D4) and composite DIS. The table reveals a clear stratification pattern: the four foundation universities and the two AACSB-accredited state universities (Istanbul University and Sakarya University) cluster at the upper end of the DIS distribution, while the majority of state universities concentrate in the 3–5 range. A notable exception is METU, which achieves a DIS of 11 without AACSB accreditation, attributable to its strong computational infrastructure and quantitative research culture. Table 2 reports descriptive statistics for all variables included in the regression analyses. The composite DIS has a mean of 7.00 (SD = 3.13) and ranges from 3 to 12, indicating substantial variation across the sample. Among the four dimensions, D2 (ERP and RPA) records the lowest mean (1.37), while D3 (Digital Competency Depth) records the highest (1.95). AACSB accreditation is held by 32% of the sample (n = 6) and foundation status by 21% (n = 4).

Table 1: Full Sample: QS Rank, GPS Coordinates, Institutional Characteristics, and Dimension Scores (D1–D4)

University	QS	GPS coordinates	Type	AACSB	D1	D2	D3	D4	DIS
METU	336	39.89°N, 32.78°E	State	No	3	2	3	3	11
ITU	404	41.11°N, 29.02°E	State	No	3	1	2	2	8
Koç Univ.	431	41.20°N, 29.07°E	Foundation	Yes	3	3	3	3	12
Bilkent Univ.	502	39.87°N, 32.75°E	Foundation	Yes	3	2	3	3	11
Boğaziçi Univ.	514	41.08°N, 29.05°E	State	No	2	2	2	2	8
Sabancı Univ.	526	40.89°N, 29.38°E	Foundation	Yes	3	3	3	3	12
Istanbul Univ.	711	41.01°N, 28.96°E	State	Yes	2	1	2	2	7
Hacettepe Univ.	761	39.87°N, 32.73°E	State	No	1	1	2	1	5
Ankara Univ.	851	39.95°N, 32.92°E	State	No	1	1	2	1	5
Yıldız Tech.	901	41.05°N, 28.99°E	State	No	2	1	2	2	7
Ege Univ.	>1000	38.46°N, 27.22°E	State	No	1	1	1	1	4
Erciyes Univ.	>1000	38.73°N, 35.48°E	State	No	1	1	1	2	5

Dokuz Eylül	>1000	38.39°N, 27.06°E	State	No	1	1	1	1	4
Marmara Univ.	>1000	40.99°N, 29.12°E	State	No	1	1	2	1	5
Atatürk Univ.	>1000	39.90°N, 41.27°E	State	No	1	0	1	1	3
Akdeniz Univ.	>1000	36.91°N, 30.70°E	State	No	1	0	1	1	3
Çukurova Univ.	>1000	37.00°N, 35.33°E	State	No	1	1	1	1	4
Sakarya Univ.	>1000	40.74°N, 30.33°E	State	Yes	2	2	2	2	8
Özyeğin Univ.	>1000	40.96°N, 29.13°E	Foundation	Yes	3	2	3	3	11

Note: METU = Middle East Technical University; ITU = Istanbul Technical University; Univ. = University; Type: State = state university, Foundation = foundation (vakıf) university; AACSB: Yes = accredited, No = non-accredited; D1–D4: 0 = absent, 1 = limited, 2 = intermediate, 3 = comprehensive; DIS = Digital Integration Score (sum of D1–D4, range 0–12); GPS = latitude/longitude (WGS84 datum); QS ranks above 1,000 are coded as 1,000 in regression analyses.

Table 2: Descriptive Statistics For All Variables (N = 19)

Variable	**N**	**Mean**	**SD**	**Min**	**Max**
Digital Integration Score (0–12)	19	7.00	3.13	3	12
D1: AI and Data Analytics	19	1.84	0.90	1	3
D2: Enterprise Resource Planning and Robotic Process Automation	19	1.37	0.83	0	3
D3: Digital Curriculum Depth	19	1.95	0.78	1	3
D4: Digital Infrastructure	19	1.84	0.83	1	3
AACSB Accreditation (0/1)	19	0.32	0.48	0	1
Foundation University (0/1)	19	0.21	0.41	0	1
QS Rank (lower = better)	19	682	295	336	1000+

Note: SD = standard deviation; DIS = Digital Integration Score (arithmetic sum of D1–D4, range 0–12); D1–D4 scores range from 0 to 3; AACSB and Foundation University are binary dummy variables coded as 1 for accredited/foundation status and 0 otherwise; QS Rank: lower values indicate better ranking position; 1000+ denotes universities ranked beyond the 1,000th position in the QS World University Rankings 2024; for regression analyses, QS ranks were standardised so that higher values denote better ranking positions.

Regression Results

Table 3 presents results from four stepwise OLS regression models. Model 1, which includes only AACSB accreditation and foundation status, explains 62.1% of DIS variance ($R^2 = 0.621$, $F = 13.10$, $p < 0.01$). Foundation status is associated with higher scores ($\beta = 4.00$, SE = 1.77, $p < 0.05$). In Model 2, QS rank substantially improves model fit ($R^2 = 0.854$, $\Delta R^2 = +0.233$, $F = 29.32$, $p < 0.01$; $\beta = 1.62$, SE = 0.33, $p < 0.01$). In Model 3, the internationalization index is not significant ($\beta = -0.10$, $p = 0.90$). Model 4 achieves the best fit ($R^2 = 0.876$, adj. $R^2 = 0.829$, $F = 18.42$, $p < 0.01$); QS rank is the strongest correlate ($\beta = 1.83$, $p < 0.01$) and AACSB accreditation is also significant ($\beta = 3.19$, $p < 0.05$). University age is not significant ($\beta = -0.38$, $p = 0.43$). These associations should be interpreted with caution given the cross-sectional design and small sample size.

Table 3: OLS Regression Results: Dependent Variable = DIS (0–12)

Variable	**M1 β (SE)**	**M2 β (SE)**	**M3 β (SE)**	**M4 β (SE)**
AACSB Accreditation	1.96 (1.55)	2.14* (0.99)	2.04 (1.72)	3.19* (1.26)
Foundation University	4.00* (1.77)	2.44 (1.18)	3.89 (2.02)	0.88 (1.63)
QS Rank (std.)	—	1.62** (0.33)	—	1.83** (0.37)
Internationalization Index	—	—	−0.10 (0.77)	−0.45 (0.53)
University Age (per decade)	—	—	—	−0.38 (0.47)
Constant	5.54** (0.57)	5.81** (0.37)	5.54** (0.58)	5.81** (0.36)
N	19	19	19	19
R^2	0.621	0.854	0.621	0.876
Adj. R^2	0.573	0.825	0.546	0.829
F statistic	13.10**	29.32**	8.20**	18.42**

Note: M1–M4 = Models 1–4 (stepwise ordinary least squares regression); β = unstandardised regression coefficient; SE = standard error (in parentheses); R^2 = coefficient of determination; Adj. R^2 = adjusted R^2; — = variable not included in the model; ** $p < 0.01$; * $p < 0.05$. QS rank is standardised so that higher values denote better ranking positions. Coefficients reflect associations in a cross-sectional observational design and should not be interpreted as causal effects.

AACSB-accredited vs. Non-accredited Institutions

Table 4 presents dimension-level mean scores separately for AACSB-accredited (n = 6) and non-accredited (n = 13) institutions. The D4 (Digital Infrastructure) dimension shows the largest effect size gap (d = 1.94), closely followed by D2 (ERP/RPA; d = 1.84), which records the lowest absolute mean across all institutions. These differences are descriptive and should not be interpreted as causal effects of accreditation.

Table 4: Dimension Means: AACSB-accredited (n = 6) vs. Non-accredited (n = 13)

Dimension	AACSB (n=6)	Non-AACSB (n=13)	Δ	Cohen's d
D1: AI and Data Analytics	2.67	1.46	+1.21	1.70
D2: ERP and RPA	2.17	1.00	+1.17	1.84
D3: Digital Curriculum Depth	2.67	1.62	+1.05	1.71
D4: Digital Infrastructure	2.67	1.46	+1.21	1.94
Total DIS (0–12)	10.17	5.54	+4.63	2.03

Note: D1 = AI and Data Analytics Integration; D2 = ERP and RPA Integration; D3 = Digital Competency Depth in Bologna Outcomes; D4 = Digital Infrastructure and Software Access; DIS = Digital Integration Score (range 0–12); Δ = mean difference (AACSB minus Non-AACSB); d = Cohen's d effect size; d > 0.8 indicates a large effect (22). Differences reflect cross-sectional associations and should not be interpreted as causal effects.

Foundation vs. State Universities

Table 5 presents dimension-level comparisons between foundation (n = 4) and state (n = 15) universities. The composite DIS difference of 5.70 points (d = 2.74) is the largest group-level contrast in the study. AACSB-accredited state universities—Istanbul University (DIS = 7) and Sakarya University (DIS = 8)—score above the state university mean, suggesting that accreditation partially compensates for resource constraints associated with state university status.

Table 5: Dimension Means: Foundation (n = 4) vs. State (n = 15) Universities

Dimension	Foundation (n=4)	State (n=15)	Δ	Cohen's d
D1: AI and Data Analytics	3.00	1.53	+1.47	2.17
D2: ERP and RPA	2.50	1.07	+1.43	2.43
D3: Digital Curriculum Depth	3.00	1.67	+1.33	2.38
D4: Digital Infrastructure	3.00	1.53	+1.47	2.53
Total DIS (0–12)	11.50	5.80	+5.70	2.74

Note: D1 = AI and Data Analytics Integration; D2 = ERP and RPA Integration; D3 = Digital Competency Depth in Bologna Outcomes; D4 = Digital Infrastructure and Software Access; DIS = Digital Integration Score (range 0–12); Δ = mean difference (Foundation minus State); d = Cohen's d effect size; d > 0.8 indicates a large effect (22). Differences reflect cross-sectional associations and should not be interpreted as causal effects.

Dimension-level Findings

D2 (ERP/RPA) records the lowest mean (1.37) and highest inter-institutional variance across all 19 universities. RPA is absent from all state university curricula as a standalone course; only Koç and Sabancı universities offer dedicated RPA workshops aligned with Bologna outcomes. D3 records the highest mean (1.95), but content analysis reveals that digital language in Bologna documents frequently appears as aspirational framing rather than evidence of enacted practice—a pattern consistent with the form-content distinction proposed in the literature (19). D1 and D4 exhibit identical means (1.84), suggesting a possible relationship between infrastructure quality and AI content delivery capacity.

Discussion

The regression results are consistent with the hypothesis that AACSB accreditation and foundation university status are positively associated with digital curriculum integration in the Turkish context. The association between QS rank and DIS in extended models is similarly consistent with the view that internationally visible institutions tend to embed digital transformation more comprehensively—a pattern noted for other domains of curriculum modernization (3, 5, 23-26). However, given the cross-sectional and observational nature of the current data, these findings must be interpreted strictly as descriptive associations; they do not permit definitive conclusions regarding whether these characteristics reflect causal effects of international accreditation and global rankings, or rather pre-existing institutional quality differences.

The magnitude of the accreditation-associated gap (Cohen's d = 2.03) is noteworthy from a policy perspective. If even partially attributable to accountability and curriculum review mechanisms embedded in accreditation processes (10), then expanding institutional incentives to a broader range of universities would require careful resource consideration. Analogous structural conditions in Brazil (CAPES framework), Poland (PKA accreditation), and several Gulf Cooperation Council (GCC)-country higher education authority models would permit future tests of this interpretation.

The AACSB association, however, demands careful interpretation. Accreditation status is not an isolated variable; AACSB-accredited institutions often possess broader organizational and financial capacities that may facilitate curriculum modernization, including stronger international networks, more extensive quality assurance mechanisms, and greater investments in digital infrastructure (26). The observed DIS differences between accredited and non-accredited institutions may therefore reflect these underlying institutional characteristics as much as the direct influence of accreditation-related curriculum review processes. In this sense, accreditation may serve as a marker of broader institutional capacity rather than as an independent driver of curriculum modification (25, 26). The cross-sectional design of the present study does not permit these alternative explanations to be disentangled, and future longitudinal or quasi-experimental studies would be needed to determine whether accreditation itself contributes to improvements in digital curriculum integration or primarily reflects pre-existing institutional advantages.

The internationalization index was not significant in any model. High foreign student percentages at Istanbul and Atatürk universities partly reflect geographic and political factors—particularly cross-border enrolments from neighbouring countries—rather than the kind of academic internationalisation that typically accompanies curriculum modernisation. University age, too, proved unrelated to digital integration scores. Longevity does not confer digital readiness; institutional type and accreditation path do (25, 26). The ERP/RPA gap is the most actionable finding for curriculum administrators. Standalone RPA courses are absent from all state university curricula, even as employer demand for automation-literate accounting graduates continues to grow (14). Part of the issue runs deeper than curriculum design: many state university accounting departments still rely on locally installed desktop accounting software—packages such as LOGO and Mikro that mirror usage patterns in Turkish SMEs—which provides no transferable experience for the ERP-integrated environments of large corporate and public sector employers (11, 13). Bologna outcome language that promises "digital competency" cannot substitute for a university SAP licence and the faculty expertise to deploy it (19). Industry partnerships and practitioner-led workshops represent the most tractable near-term pathway, as the Koç and Sabancı cases already demonstrate (25).

The findings should also be situated within the broader landscape of professional accounting competency frameworks. The AICPA/NASBA CPA Evolution initiative restructured the US CPA licensure model in 2024 to place technology and data analytics at the core of the examination, signalling a systemic shift in what professional bodies consider foundational accounting knowledge (23). IFAC has emphasised that sustainability reporting and ESG (environmental, social, and governance) analytics are rapidly becoming expected competencies for professional accountants, given the growing demands of integrated and sustainability-based financial reporting (24, 27-29). The present study's DIS framework does not capture sustainability reporting competency as an independent dimension, and none of the 19 sampled Turkish universities demonstrated discernible ESG analytics content within their analyzed accounting curricula at the time of data collection. The absence of standalone ESG analytics content within the analyzed undergraduate accounting curricula in the current sample highlights a potential area for future curriculum review. As ESG disclosure expectations intensify under frameworks such as the IFRS Sustainability Disclosure Standards and the European Corporate Sustainability Reporting Directive (CSRD), accounting graduates who lack sustainability reporting competencies face a growing professional skills deficit (24, 27-29).

Future extensions of the DIS instrument should incorporate ESG analytics and sustainability reporting as a fifth dimension (24, 27, 28).

National higher education policy is an important contextual factor shaping the pattern of results. State universities in Türkiye operate under binding programme credit limits and mandatory course requirements set by YÖK, which constrain their ability to introduce new mandatory digital courses without displacing existing ones (17). A faculty wishing to add a mandatory SAP or data analytics course must typically surrender an existing elective slot—often a management accounting or financial analysis course—to stay within YÖK's total credit ceiling for the programme. That displacement cost alone can stall curriculum reform for academic years. State university DIS scores therefore cluster at the lower end of the distribution not simply because of limited awareness or intent, but because the regulatory architecture makes structural redesign slow and costly (5, 6). Curriculum modernisation in this context is not purely a matter of institutional choice; it is, to a significant degree, a function of the space YÖK regulations leave open. A targeted revision of YÖK programme frameworks to include minimum digital competency requirements across all accounting and business programmes would create a system-level lever that individual institutional initiatives cannot replicate (3, 4, 25).

Conclusion

This study examined institutional correlates of digital transformation integration in undergraduate accounting education across 19 Turkish universities using a standardized, multi-dimensional scoring instrument with documented inter-rater reliability, and OLS regression analysis. AACSB accreditation is the most consistent positive correlate of digital integration scores across model specifications; foundation university status is associated with higher scores in simpler models but loses significance when QS rank is controlled for. QS rank is significant in extended models; university age is not.

Three policy-relevant observations follow. First, program administrators may wish to expand ERP and RPA content, particularly in state universities where this dimension is most consistently absent. Second, university-industry partnerships can strengthen access to digital accounting tools and support practice-based competency development. Third, digital competency language in Bologna learning outcomes should be accompanied by corresponding teaching and assessment structures, rather than functioning purely as aspirational documentation.

Several limitations should be noted. Analyses rely on secondary data, and differences between documented curricula and classroom practice may be substantial; publicly available syllabi and Bologna outcome documents reflect formally stated curriculum intent rather than enacted pedagogical reality, and the quality, depth, and currency of actual digital instruction may diverge from what is formally recorded. The small sample size (N = 19) limits statistical power and increases the risk of unstable coefficient estimates, particularly in the stepwise models that include multiple predictors simultaneously; the adjusted R^2 values should be interpreted as descriptive rather than predictive indicators, and the possibility of overfitting in Model 4 cannot be excluded. Coding QS ranks above 1,000 as a single value reduces the sensitivity of this variable. The cross-sectional design does not allow temporal tracking of curriculum changes, and the exclusion of non-QS-listed universities constitutes an elite institutional bias that limits the generalisability of findings to the broader Turkish higher education system. Additionally, while the data reflect the comprehensive curriculum profiles of the 2024–2025 academic year, higher education programs undergo periodic restructuring. Although these findings capture the institutional landscape of the current era, future longitudinal studies are encouraged to track subsequent curricular adaptations. A data availability asymmetry is present for Hacettepe University, whose Bologna course-list pages required session authentication and could not be directly accessed; its dimension scores are based on secondary sources and may carry greater measurement uncertainty than those of other institutions. The DIS instrument does not independently capture several competency domains increasingly considered important by professional standard-setters, including cybersecurity, cloud accounting systems, blockchain-based financial reporting, digital ethics, and ESG analytics; the absence of these dimensions means that DIS scores represent a partial view of digital curriculum integration.

Finally, the comparability of scores across universities with standalone accounting degrees versus those where accounting is embedded within broader business programs is constrained by differences in programme structure, and the scoring decisions applied in these cases introduce a degree of methodological judgement that future work should address through primary data collection.

Future research could address these limitations by expanding the sample to non-QS-listed universities, incorporating primary data from students, faculty, and employers, and conducting longitudinal or cross-country comparisons. Replicating the DIS framework in analogous emerging economies such as Brazil, Poland, or Egypt would enable tests of whether the accreditation-integration association generalizes beyond the Turkish context. Longitudinal designs tracking curriculum changes following accreditation would more directly address questions of causality.

Abbreviations

AACSB: Association to Advance Collegiate Schools of Business, AI: Artificial Intelligence, DIS: Digital Integration Score, ECTS: European Credit Transfer and Accumulation System, ERP: Enterprise Resource Planning, IFAC: International Federation of Accountants, OLS: Ordinary Least Squares, RPA: Robotic Process Automation, SD: Standard Deviation, YÖK: Council of Higher Education (Yükseköğretim Kurulu).

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Author Contributions

Anil GACAR: Conceptualization, methodology, data collection, formal analysis, writing—original draft, writing—review and editing, and final approval of the manuscript.

Conflict of Interest

The author declares no conflict of interest.

Data Availability

The data supporting the findings of this study are derived from publicly available secondary sources including official university websites, ECTS/Bologna databases, and accreditation registries. Scoring data are available from the corresponding author upon reasonable request.

Declaration of Artificial Intelligence (AI) Assistance

The author declares that an AI-assisted technology was utilized solely for the purpose of English grammar checking, stylistic enhancement, and language editing to improve the readability of the manuscript. The AI tool was not used for data analysis, interpretation of findings, or drawing structural conclusions, and the final content remains entirely the scholarly responsibility of the author. Specifically, ChatGPT (OpenAI) was used for grammar and language editing purposes only.

Ethics Approval

Not applicable. This study used only publicly available secondary data from official university websites, ECTS/Bologna databases, and accreditation registries. No human participants, animals, or clinical interventions were involved. No patient data, informed consent, or institutional ethics committee approval was required.

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Appendix A: Digital Integration Score (DIS) Coding Rubric

The coding rubric below operationalizes each of the four dimensions of the Digital Integration Score (DIS). For each dimension, level descriptors and anchor examples are provided. Each dimension is scored 0–3; scores are summed to yield the composite DIS (range 0–12). All level descriptors were calibrated against IFAC IES 2 and 4 (4) and AACSB 2020 BSBA Technology Integration Standards (3).

Table A1: Coding Rubric for D1: AI and Data Analytics Integration

Score	Level	Descriptor	Anchor Examples
0	Absent	No course content related to AI, machine learning, or data analytics is present in the curriculum or Bologna outcomes.	No AI/analytics course or mention in any syllabus or Bologna outcome.
1	Limited	AI or analytics content mentioned in a single course description but not delivered as a standalone course; lacks hands-on components.	One lecture on 'digital trends' in an introductory IT course.
2	Intermediate	At least one elective course dedicated to data analytics or AI applications; or AI content embedded substantively (≥3 weeks) in a mandatory course.	Elective 'Business Analytics with Excel/R'; mandatory course with dedicated analytics module.
3	Comprehensive	Mandatory course covering AI or data analytics with hands-on software components (R, Python, Tableau, Power BI); reflected in Bologna outcomes and assessed through project or lab work.	Mandatory 'Data Analytics in Accounting' using Python/R with Bologna outcome on analytical tool application.

Note: Scores are assigned based on documented course content, not course titles alone. Level 3 requires hands-on software delivery and explicit Bologna outcome alignment. R = statistical programming language; AI = artificial intelligence.

Table A2: Coding Rubric for D2: ERP and RPA Integration

Score	Level	Descriptor	Anchor Examples
0	Absent	No ERP or RPA content present in any course syllabus, catalogue, or Bologna outcome.	No SAP, Oracle, Microsoft Dynamics, or RPA mention in any curriculum document.
1	Limited	ERP systems mentioned within a broader IT course; no dedicated course or hands-on lab documented.	One-week ERP module within 'Management Information Systems'; SAP as example only.
2	Intermediate	At least one elective ERP course with documented software access; or ERP constitutes ≥25% of a mandatory course. No standalone RPA course.	Elective 'SAP Fundamentals' with university SAP lab license.
3	Comprehensive	Mandatory ERP course with certification-track content AND at least one dedicated RPA workshop or course; both reflected in Bologna outcomes.	Mandatory 'ERP and Process Automation' course; dedicated RPA workshop aligned to Bologna outcomes.

Note: Scores are assigned based on documented course content, not course titles alone. Level 3 requires both a mandatory ERP course and a dedicated RPA workshop, each aligned with Bologna outcomes. ERP = enterprise resource planning; RPA = robotic process automation; SAP = Systems, Applications and Products.

Table A3: Coding Rubric for D3: Digital Competency Depth in Bologna Outcomes

Score	Level	Descriptor	Anchor Examples
0	Absent	No digital competency language present in any program-level Bologna outcome.	Bologna outcomes limited to accounting standards and professional ethics.
1	Limited	Generic digital literacy mentioned in one Bologna outcome; phrasing is aspirational and not linked to specific courses.	Bologna outcome: 'Students will be aware of the role of technology in business.'
2	Intermediate	Digital competency referenced in 2–3 Bologna outcomes; at least one linked to a specific course but assessment alignment is partial.	Bologna outcomes include 'use of spreadsheet tools for financial

			modelling' linked to a mandatory course.
3	Comprehensive	Digital competencies in ≥4 Bologna outcomes; each linked to a specific course and assessed through documented assignments, projects, or lab exams. Outcomes reference specific technologies.	Four Bologna outcomes covering data analytics, ERP, AI awareness, and digital reporting; each with documented assessment.

Note: Scores are assigned based on programme-level Bologna outcome documents. Generic digital language without course linkage is coded at Level 1. Bologna outcomes must reference specific tools or competencies to qualify for Level 2 or above.

Table A4: Coding rubric for D4: Digital Infrastructure and Software Access

Score	Level	Descriptor	Anchor Examples
0	Absent	No dedicated digital infrastructure for accounting software; no computer laboratory or licensed software for accounting courses is documented in any publicly available institutional source.	No SAP, ERP, data analytics, or accounting-specific software mentioned in any course syllabus, programme catalogue, or Bologna documentation.
1	Limited	Basic computer laboratory access documented, limited to standard office productivity software (e.g. Microsoft Excel, Word); no licensed specialist accounting or analytics software confirmed in any course or Bologna documentation.	IT/computer lab available but limited to spreadsheet applications; mandatory accounting courses reference Excel use only; no ERP or analytics platform licensed.
2	Intermediate	At least one specialist accounting or analytics software package (e.g. SAP, QuickBooks, Sage, Power BI, or Tableau) documented in a course syllabus or Bologna outcome; access may be restricted to elective course enrolees or a sub-set of students.	Elective course uses a university SAP site licence; or Power BI available in selected lab sessions for an analytics elective; or cloud-based accounting software (e.g. QuickBooks Online) accessible for one course cohort.
3	Comprehensive	Documented access to multiple specialist software environments (minimum: one ERP system AND one data analytics/visualisation tool); access confirmed for all enrolled accounting students as part of mandatory course requirements; software access aligned with Bologna learning outcomes that specify digital tool proficiency as an assessed competency.	Mandatory ERP course using SAP with university site licence available to all accounting students; mandatory data analytics lab using Python, Tableau, or Power BI; both documented in Bologna outcomes with assessed lab components and verified software access.

Note: Software access must be confirmed through course documentation, not assumed from institutional IT reports alone. Cloud-based access via institutional licences (e.g. SAP University Alliance, Microsoft Azure for Education) qualifies if referenced in a course syllabus or Bologna outcome. Level 3 requires both an ERP system and a data analytics tool to be simultaneously accessible to mandatory-course enrolees. ERP = enterprise resource planning; SAP = Systems, Applications and Products; Power BI = Microsoft Power Business Intelligence.